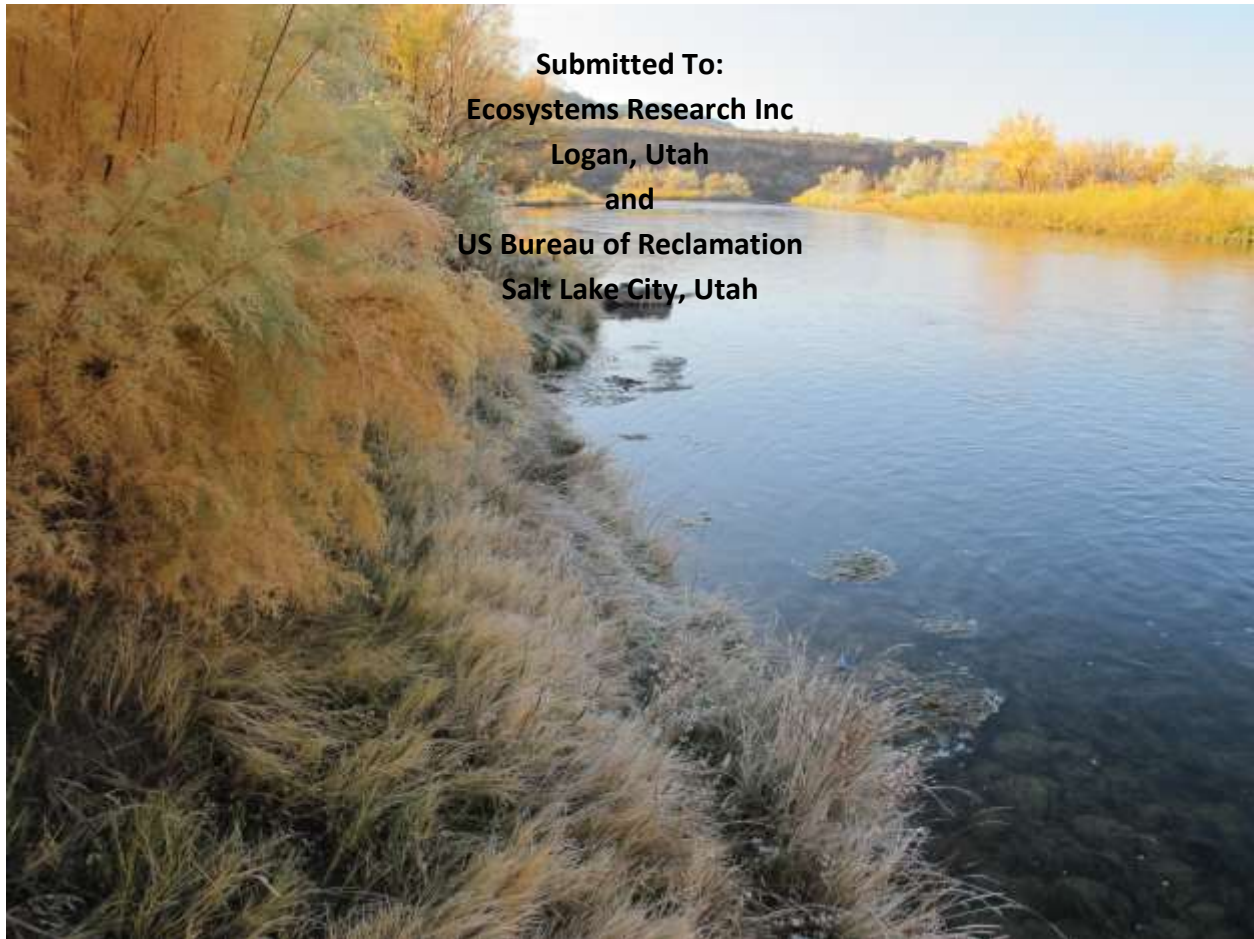


**Final**

**SAN JUAN RIVER BASIN RECOVERY IMPLEMENTATION PROGRAM  
WATER TEMPERATURE MONITORING**

**2015 ANNUAL REPORT**



**Submitted To:  
Ecosystems Research Inc  
Logan, Utah  
and  
US Bureau of Reclamation  
Salt Lake City, Utah**

**Submitted By:  
William J. Miller  
Miller Ecological Consultants, Inc  
Bozeman, Montana**

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**MILLER  
ECOLOGICAL  
CONSULTANTS, INC.**  
[www.millereco.com](http://www.millereco.com)

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## INTRODUCTION

As part of the San Juan River Basin Recovery Implementation Program (SJRIP), water temperature and hydrology studies have been undertaken since 1992. This report summarizes the water temperature data collected from October 1, 2014 to September 30, 2015 as part of the long-term monitoring program.

### Objectives

- 1. Monitor water temperature at five existing locations in the San Juan River, NM and UT (Figure 1).***

In 2014/15, five locations were monitored for water temperature by USGS real-time monitoring. Data collection was transferred to the USGS as a means to continue long-term monitoring without some of the difficulties associated with separate loggers. It provides real-time data retrieval for use by any researcher rather than end-of-year reporting. Further, the data are archived in USGS permanent records and simplify database administration for the San Juan Program.

The following locations were monitored by the USGS: San Juan River at Archuleta, San Juan River at Farmington, Animas River at Farmington and San Juan River at Four Corners. The USGS already maintains a real-time, continuous monitor at Mexican Hat (USGS gage 09379500, San Juan River near Bluff, UT). These locations were chosen because they currently have USGS gages that monitor discharge.

- 2. Add FY2015 data to the water temperature database, which can be accessed at the SJRIP website.***

The FY2015 water temperature data have been submitted using the same format as in previous years.

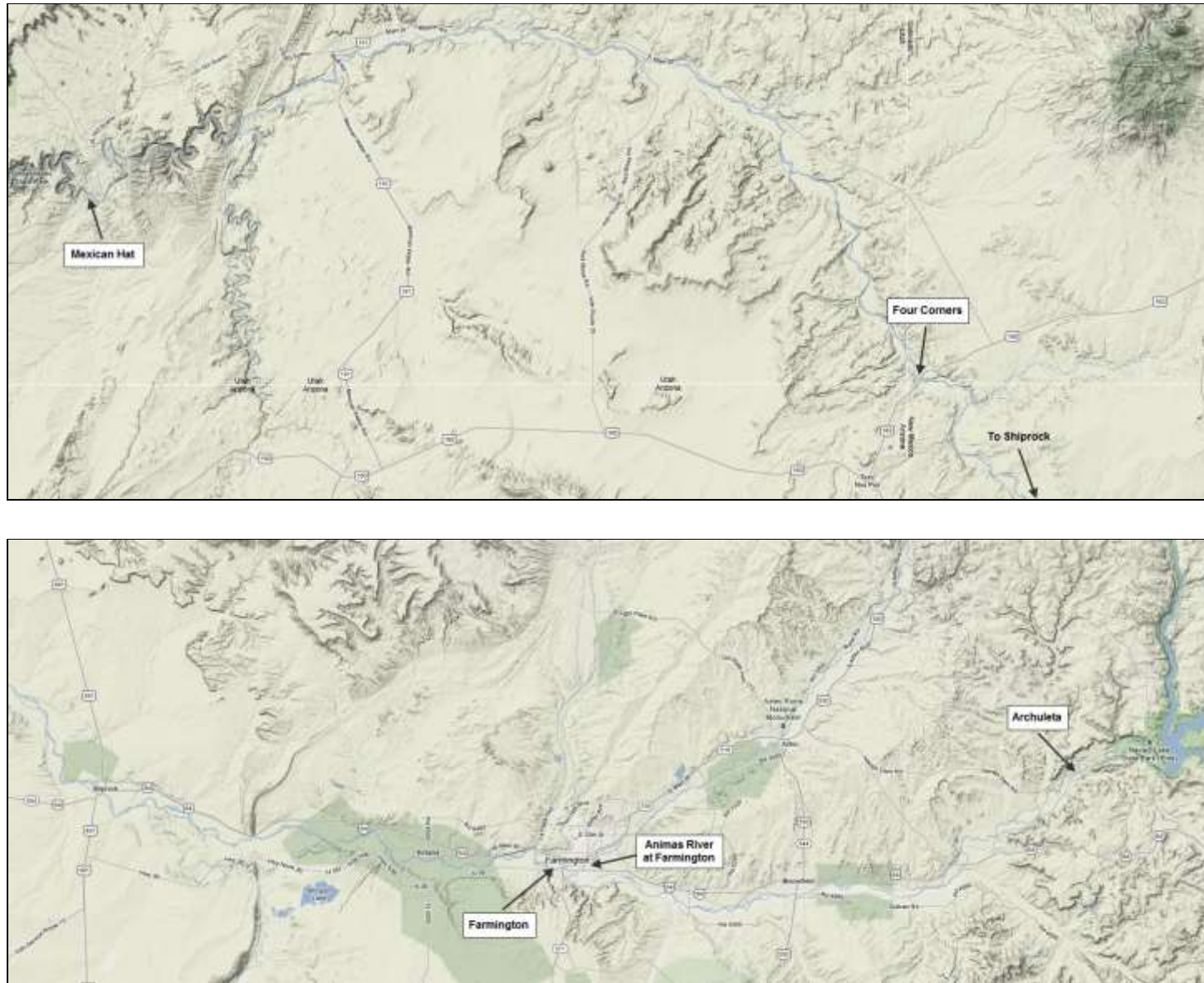


Figure 1. Water temperature monitoring locations. Map courtesy of Google maps.

## METHODS

Water temperature has been recorded since the summer of 1992 at the locations shown in Table 1 (not including the two locations established in 2011). Those data are found in reports posted to the San Juan River Recovery Implementation website. Water temperature and discharge data were downloaded from the USGS's website every 2-3 months. Fifteen-minute temperature data were summarized into daily values using R software (R Development Core Team 2013).

Quality-checked temperature data were added to the Microsoft Access database that contains all 15-minute data from each site. The database also contains tables that summarize daily maximum, minimum and mean temperature for each site. Daily average water temperatures at each site were then plotted along with the daily hydrograph of the San Juan River. Discharge data were obtained from the USGS gages listed in Table 1.

## RESULTS & DISCUSSION

There was no large release of water from Navajo Dam in 2015. Average daily flow at the Archuleta gage peaked at 1390 cubic feet per second (cfs) on August 7, 2015 (Figure 2). This was much lower than the peak of nearly 5200 cfs that came from the most recent release in 2012. Peak flows in August were not associated with the flow recommendations, since those releases aim to mimic the natural hydrograph and occur in May or June. Water temperature did decrease with the increases in flow in April and August. The peak average daily temperature at Archuleta occurred on July 11 and was 12.6°C.

Flows in the Animas River began to increase from base levels in April, peaking at 8810 cfs on June 11 (Figure 3). Once flows subsided in June, temperature rose steadily through the remainder of the month and through most of July. The maximum average daily temperature was 24.4°C and occurred on August 16, 2015.

Temperatures in the Animas River were mostly cooler than the San Juan River at Farmington until mid-July (Figure 4). Since flows were much greater in the Animas River compared to flows at Archuleta, it is likely that the Animas River served to cool temperatures in the San Juan River during runoff.

For the San Juan River at Farmington, average daily flow peaked at 7590 cfs on June 14 and was almost entirely due to flows from the Animas River. The maximum average daily temperature was 20.9°C and occurred on August 14, 2015 (Figure 4). Water temperature did not exceed 20.0°C until the first week in July (Figure 5).

The peak flow at Four Corners was 7870 cfs on June 12, 2015 (Figure 6). The maximum average daily water temperature was 23.7°C on July 26, 2015 (Figure 6). Water temperature exceeded 20.0°C in early

April, which is two months earlier than the San Juan River at Farmington. Maximum water temperatures remained near or exceeded 20.0°C through September except for the short runoff in the second week of June (Figure 7).

Peak flow at Mexican Hat was 8570 cfs on June 12, 2015. The maximum average daily water temperature was 25.9°C and occurred on August 17, 2015 (Figure 8). Temperature patterns were generally similar to those observed at other locations. There was very little change in water temperature associated with the peak flow. This was likely due to the majority of the discharge at peak originating from the Animas River and not from a cold water release from Navajo Dam. Water temperature first exceeded 20.0°C in the last week of April and remained near or above 20.0°C through September (Figure 9).

**Table 1. Water temperature monitoring locations.**

Location	River Mile	UTM Zone	UTM Northing (m)	UTM Easting (m)	Comments
Archuleta – San Juan at USGS gage location	218.6	13S	4076301	259235	Discontinued May 2014; transferred to USGS
Farmington – San Juan at USGS gage location	180.1	12S	4067579	747929	Discontinued May 2014; transferred to USGS
Four Corners – San Juan at USGS gage location	119.4	12S	4096658	675400	Discontinued May 2014; transferred to USGS
Mexican Hat – San Juan near Bluff gage location	52.1	12S	4112151	600678	Loggers lost as of Oct. 2013; use USGS
Animas at Farmington – Animas River at USGS gage location	n/a	12S	4067756	749902	Discontinued May 2014; transferred to USGS



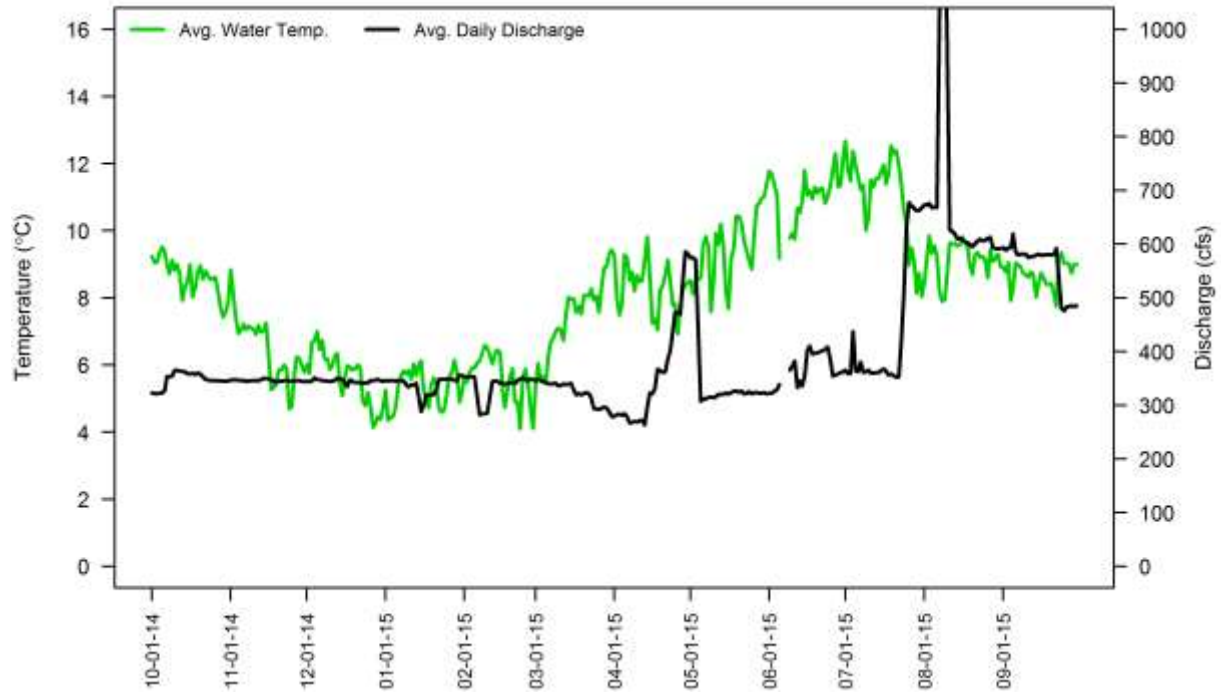


Figure 2. Average daily water temperature at Archuleta compared to discharge at Archuleta.

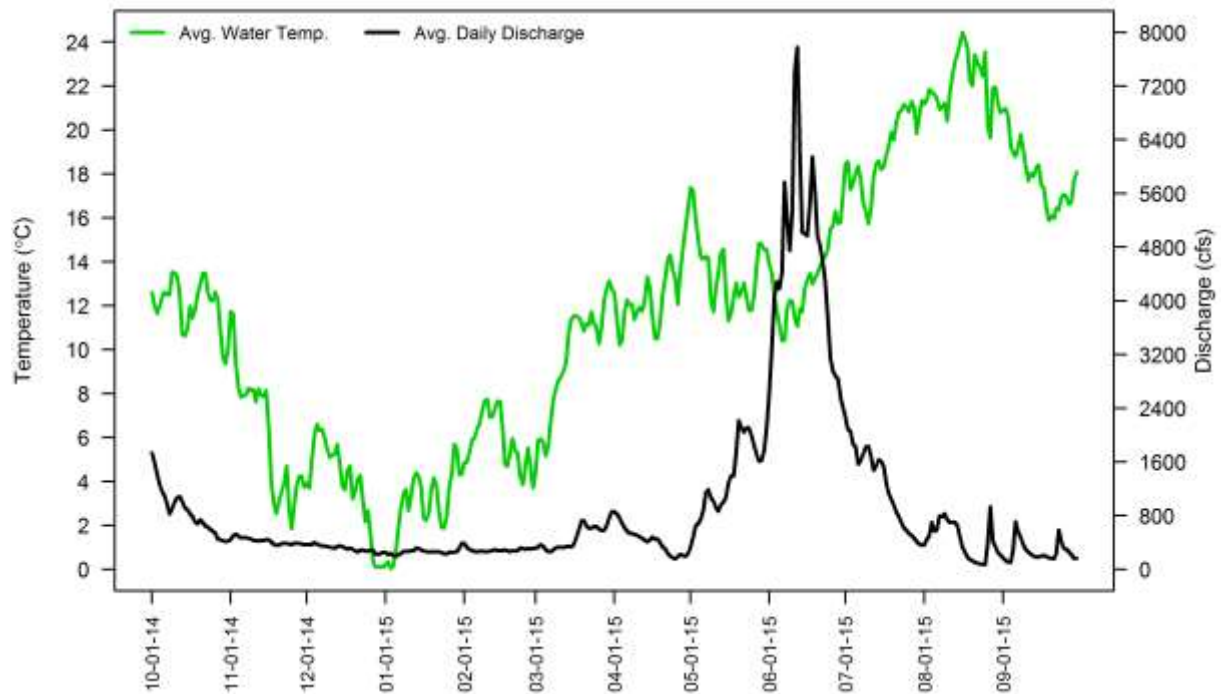
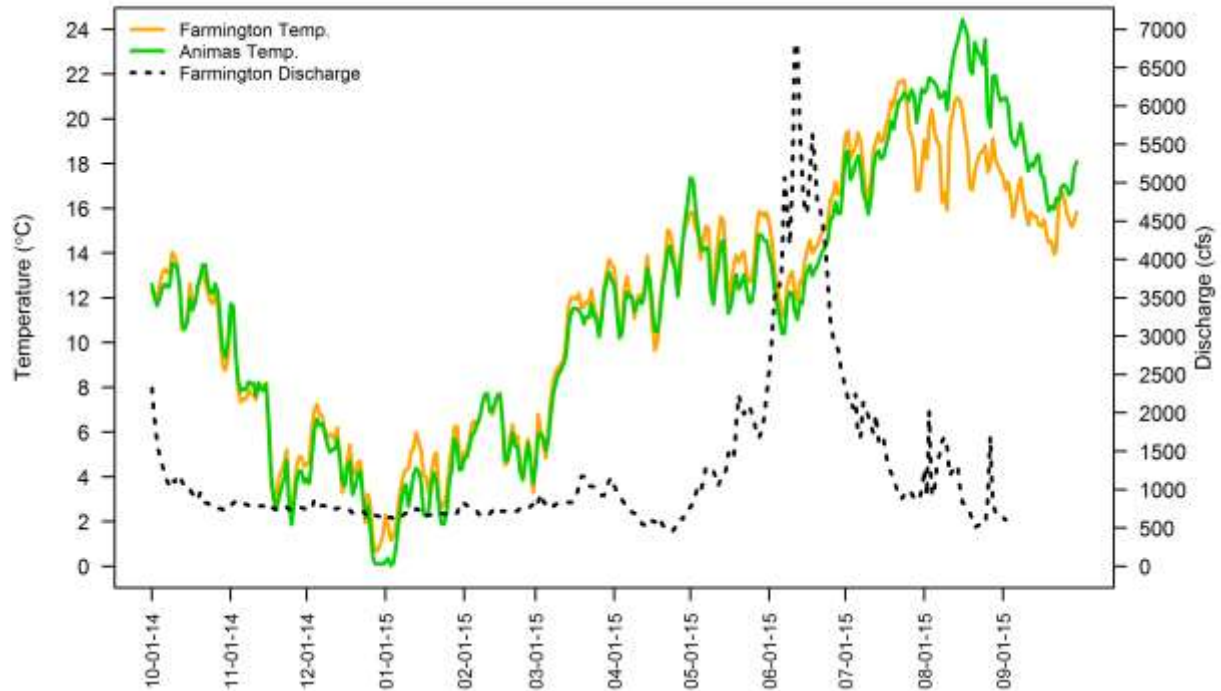
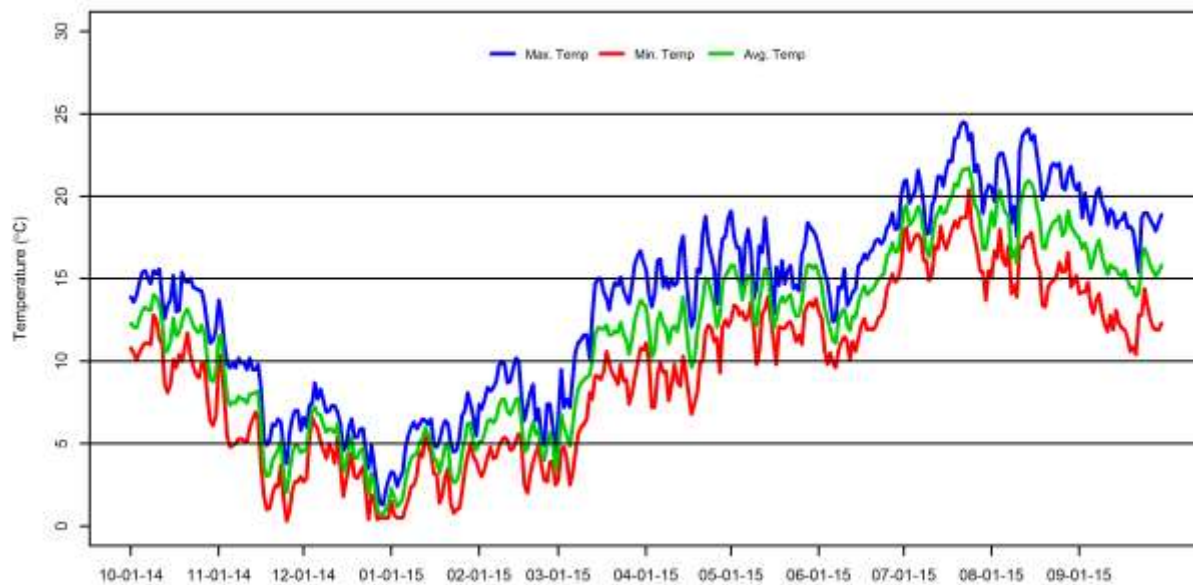


Figure 3. Average daily water temperature on the Animas River near Farmington compared to discharge on the Animas River.



**Figure 4. Average daily water temperature on the Animas River (Animas Temp.) and the San Juan River at Farmington (Farmington Temp.) compared to San Juan River discharge at Farmington (Farmington Discharge).**



**Figure 5. Average daily, maximum daily and minimum daily water temperature for the San Juan River at Farmington.**



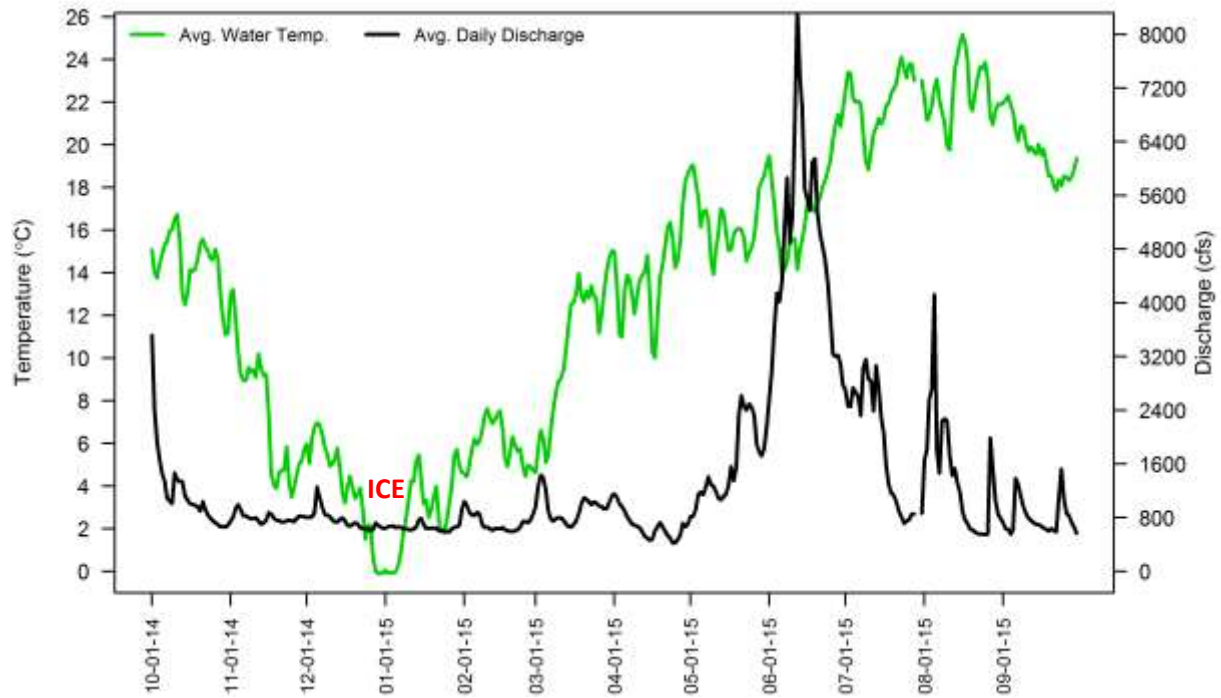


Figure 6. Average daily water temperature at Four Corners compared to discharge at Four Corners.

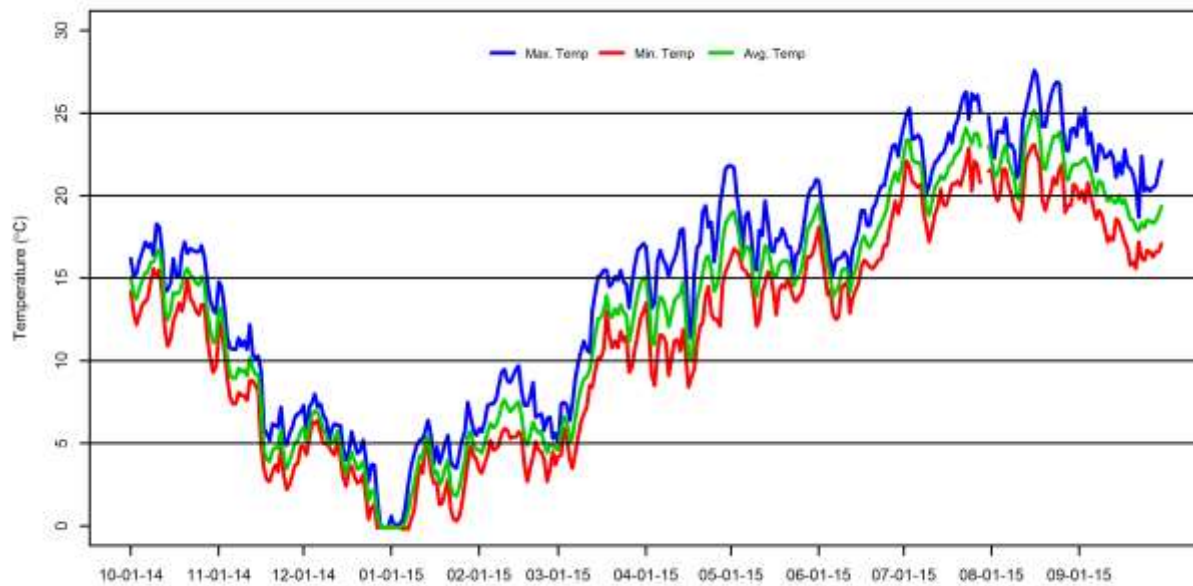


Figure 7. Average daily, maximum daily and minimum daily water temperature for the San Juan River at Four Corners.

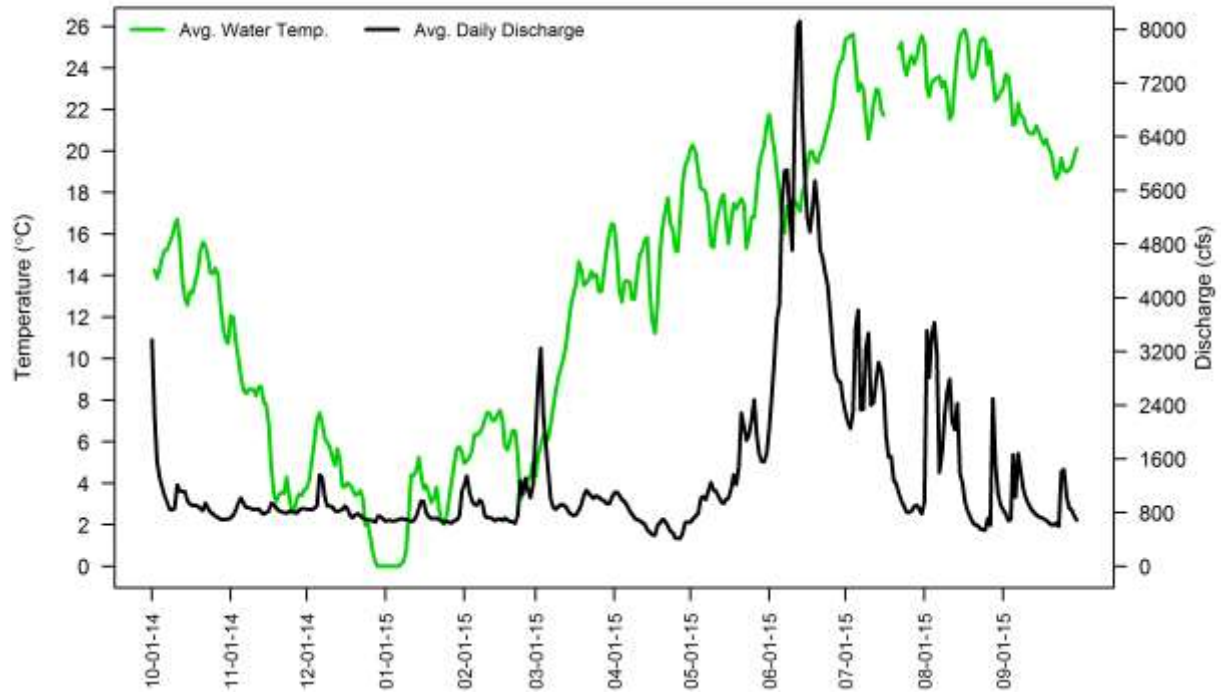


Figure 8. Average daily water temperature at Mexican Hat compared to discharge at Mexican Hat.

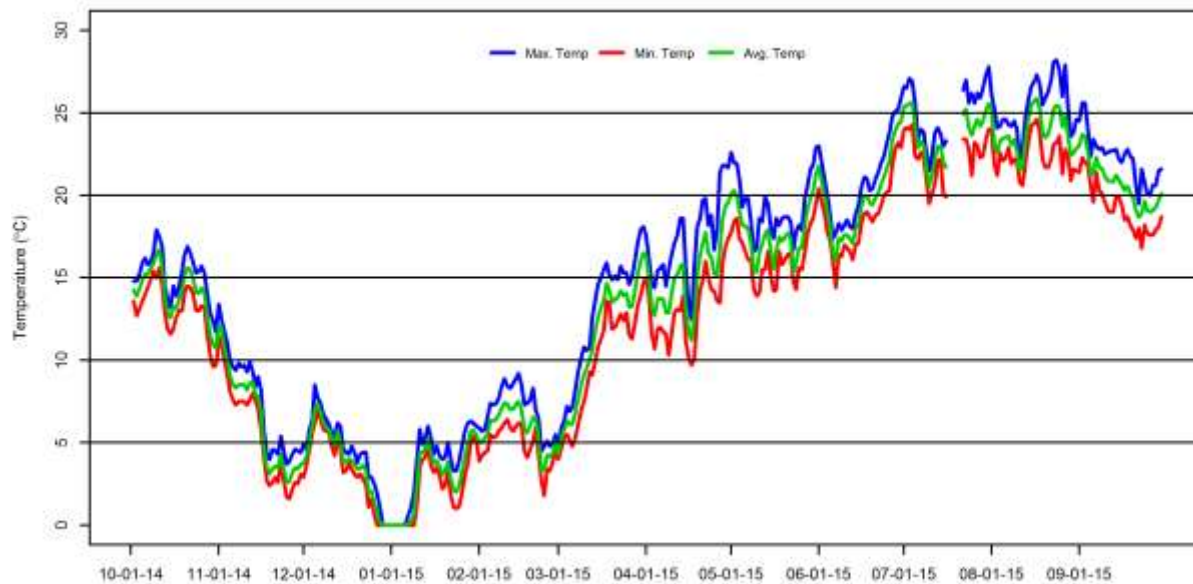


Figure 9. Average daily, maximum daily and minimum daily water temperature for the San Juan River at Mexican Hat.

In summary, water temperature monitoring provides documentation of annual thermal regimes in the San Juan River. Water temperature monitoring is one component of the habitat monitoring program specified in the San Juan River Recovery Implementation Program Long Range Plan. These monitoring data could be used for investigations of impacts of water temperature on the San Juan River fish community.

## **REFERENCES**

R Development Core Team. 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.